# Commodity Node Procurement Process Task Force: Status

Stephen Wolbers
Run 2 Computing Review
September 13, 2005

## Outline

- · Charge and Organization
- · Research and Discovery Topics
- Plans for Completion

# Some Background

- Procurement of 1000's of PCs takes a large amount of effort.
- Housing all of these machines takes a huge (Megawatts) amount of power.
  - Should we be thinking about "performance per watt"?
- It is useful to examine the procedure used in recent years:
  - Vendor evaluation to qualify vendors.
  - Limited bids
  - 30 day burn-in for acceptance
  - Integrated PC/rack (Fermilab specifies rack configuration)
  - No real consideration for power, cooling, space in bid evaluations.
- · Some recent acquisitions have had problems.
  - Technical problems/failure during burn-in.
  - Leads to delays in getting the computing in production.
  - Can we do better?
- Many ideas for improving the process exist and may benefit all of us.

# Charge and organization

- Charge to the task force was sent to department heads June 2, 2005 by Vicky White.
  - CD-doc-886
- Steve Wolbers was asked to lead the task force.
- Mark Fischler was asked to serve to assist to formulate economic models.
- Departments were asked to nominate people and the task force has membership from CSS, CMS, Running Experiment, CEPA, CCF.
- Work began in June and was interrupted once or twice by vacations.

# Charge

#### The task force is asked to:

- 1) Consider the existing procurement strategy and its pros and cons.
- 2) Hear stakeholder and provider ideas about possible modifications to the procurement process, including input from procurement and facilities providers.
- 3) Consider the economic model of what it actually costs us to procure, install and run systems over their lifetime. Here factors such as space, power, repairs, vendor liaison and visits, time spent on installs or vendor education, risk, integration costs, and more might be taken into account in a full economic model
- 4) Consider which aspects of the economic model might in some way be considered in evaluating the value of a vendor's response to a bid.
- 5) Consider whether the acceptance process is optimal for rejecting systems. Since it is actually hard to send systems back in reality the acceptance process has turned out to be merely the first step in the long process of owning systems and making them run reliably enough, including working with the vendor to address deficiencies.
- 6) Recommend a procurement and acceptance strategy for the future. The goal is to maximize the utility of the computers while minimizing the total cost, including costs associated with the procurement and operation of the systems.

# Deliverables and Timescales (1)

#### From the charge:

- "Recommendation for either maintaining the current process or making some short term do-able modifications to it. We will need these before the end of June."

#### · Committee's recommendation (June 20, 2005):

- 1) Lattice QCD should use their standard process.

2) Run 2 and GP Farms can use the current process with necessary updates. Changes to take into account vendors, IPMI infrastructure, power, cooling and space needs, etc. are all within the boundaries of the current procurement methodology.

The task force considered the possibility of recommending that the process used for the FY05 CMS node procurement be used for other FY05 procurements. However, the FY05 CMS process won't be finished until August-September, 2005. It is too early to evaluate that procurement at this time.

Even though the task force cannot recommend the use of the FY05 CMS procurement process for remaining FY05 purchases the task force believes that it should be an

## Deliverables and Timescales (2)

- · From the charge:
  - "Recommendation for procurement an acceptance processes for future procurements. We will need this before October 1."
- We won't make it by October 1 but we plan to be finished before the FY06 procurement cycle begins.

# Topics Covered or Scheduled

- Computer Room Facilities Cost
  - Space, Power, Cooling
- Vendor and Hardware Qualification
- · Concepts for Modeling Node Procurement
- · PC Farm Acquisitions at Other Labs
  - Argonne, BNL, CERN, JLAB
- · Lattice QCD Procurement
- · Economic Models for Bid Evaluation Formula
- Meeting with Fermilab Procurement Department
- CMS Procurement Strategy FY05 and Plans and Ideas for the Future
- · Moore's Law
- Racking/Packaging

<sup>\*</sup> All of these are documented in CD docDB

### Recent Construction Costs



Max Raoks         533         72         94         32         52         1333         21           Avg Raok Avg Raok Power         1         10         10         6.25         11         21         23         26         29         0.4         1         21         0.34         20         0.34         0.34         0.35	CD Computer	Poors Infra	etruoturo Li	imite and C	ortr					
Total Power   FCC11/2   GCC(A)   GCC(TR)   GCC(B)   LCC(107)   FCC Upgrade   Greenfield Site   "ACME"   Total Power   FCM	CD Computer	Room mira	istructure L	Imits and C	I					
Total Power   FCC11/2   GCC(A)   GCC(TR)   GCC(B)   LCC(107)   FCC Upgrade   Greenfield Site   "ACME"   Total Power   FCM										
Total Power KW 679 840 840 640 500 550 not designed 77 Total Cooling KW 700 720 840 200 550 77 Total Sq Ft 16.000 2.200 2.300 2.300 1.500 3.000 40.000 1.120 89 FT 16.000 2.200 2.300 2.300 1.500 3.000 40.000 1.120 89 FT 16.000 2.200 2.300 2.300 1.500 3.000 40.000 1.120 89 FT 17 8.000 1.120 89 FT 18.000 89 FT		F00410	000/41	OOO(TEX	000/P)			50011		
KW	T-4-1 D	FCC1/2	GCC(A)	GCC(TR)	GCC(B)	LCC(108)	LCC(107)	FCC Upgrade	Greenfield Site	"ACME"
Total Cooling KW W 700 720 840 200 650 77 Total Sq Ft 16,000 2,200 2,300 2,300 1,500 3,000 40,000 1,121 Rack Space Sq Ft 3,200 432 504 192 312 8,000 124 Max Racks Fower Power Power Power Power Power Post St Build SM 10 2,2 0,675 2,9 0,4 1 2,1 0,33 0,3 0,3 0,3 0,5 0,5 0,5 0,5 0,5 0,5 0,5 0,5 0,5 0,5			l							
Year   Ten		678	840		840	500	550	not designed		78
Total Sight										
Rack Space										
Sq. Ft   3,200   432   504   192   312   8,000   120		16,000	2,200	2,300	2,300	1,500	3,000		40,000	1,120
Max Raoks         533         72         94         32         52         1333         20           Avg Raok Power         1         10         10         6.25         11         21         333         20           Cest Sk per Sep Fix Build         0.8         1.0         0.29         1.3         0.3         0.3         0.53         0.3           Cest Sk per Sep Fix 3 Yrs         0.21         0.33         0.10         0.42         0.1         0.1         0.18         0.2           Cest Sk per Sep Fix 3 Yrs         0.21         0.33         0.10         0.42         0.1         0.1         0.18         0.18         0.2           Cest Sk per Sep Fix 3 Yrs         0.21         0.33         0.10         0.42         0.1         0.1         0.18         0.18         0.2           Cest Sk pace Watts/Sep Fix         42         327         365         133         183         70         70         70         20         40         656         656         656         656         656         656         656         656         656         656         656         656         656         656         656         656         656         656         656										
Avg Rack Power Density KW 1 10 10 10 8.25 111  4 Cost to Build SM 10 2.2 0.675 2.9 0.4 1 21 0.36  Cost \$K per Sq Ft to Build 0.8 1.0 0.29 1.3 0.3 0.3 0.3 0.53 0.3  Cost \$K per Sq Ft to Build 0.8 1.0 0.29 1.3 0.3 0.3 0.3 0.53 0.3  Cost \$K per Sq Ft to Build 0.8 1.0 0.42 0.1 0.1 0.1 0.18 0.5  Cost \$K per Sq Ft 9	Sq Ft				504	192				120
Power Power Density KW 1 10 10 6.25 11 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Max Racks	533	72		84	32	52		1333	20
Density KW	Avg Rack									
Cost to Build	Power									
\$M	Density KW	1	10		10	6.25	11			4
Cost \$K per Sq Ft to Build	Cost to Build									
Cost \$K per Sq Ft to Build	SM	10	2.2	0.675	2.9	0.4	1		21	0.35
Sq Ft to Build										
Sq Ft to Build	Cost \$K per									
Cost SK per Sq. Ft/ 3 Yrs		0.6	1 10	0.29	13	0.3	0.3		0.53	0.3
Sq Ft/ 3 Yrs		0.0	1.0	0.20	1.0	0.0	0.0		0.00	0.0
Cost \$K per Rack Space		0.21	022	0.10	0.42	0.1	0.1		0.10	٠.
Rack Space 19 31 35 13 19 18 Floor Space Watts/Sq Ft 42 327 385 133 183 77 Rack Space Watts/Sq Ft 212 1687 1687 1042 1783 656 Cost to Build Sk//W 15 3 3 2 2 2 4 Facilities Maint Sk//Yr 150 70 70 20 40 66 COD/OPS FTE 1.00 0.50 0.10 0.50 0.25 0.25 1.00 Sysadmin Networking FY05 FY08 FY07 Elec \$/KW-HR 0.048 0.052 ? Upgrades FY02 FY03 FY04 FY05 FY08 FY07 Total FCC Gen/UPS 6.50 0.25 1.00 FCC Gen/UPS 0.5 FCC GRA 0.2 2 2 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		0.21	0.55	0.10	0.42	0.1	0.1		0.10	0.
Floor Space Watts/Sq Ft										٠.,
Watts/Sq Pt         42         327         365         133         183         70           Rack Space         Watts/Sq Pt         212         1667         1667         1042         1763         650           Cost to Build Sk/KW         15         3         3         2         2         4           Facilities         Maint \$k/Yr         150         70         70         20         40         60           CDO/OPS FTE         1.00         0.50         0.10         0.50         0.25         0.25         1.00           Sysadmin         Networking         FY05         FY08         FY07         Elec \$/kW-HR         0.048         0.052         ?         Upgrades         FY02         FY03         FY04         FY05         FY06         FY07         Total           FCC         Gen/UPS         3.5         FCC GR         GEN/UPS         3.5         FY04         FY05         FY06         FY07         Total           FCC GC GRA         GEN/UPS         3.5         FY04 <td></td> <td>19</td> <td>31</td> <td></td> <td>35</td> <td>13</td> <td>19</td> <td></td> <td></td> <td>18</td>		19	31		35	13	19			18
Rack Space Watts/Sq Ft 212 1687 1687 1042 1763 656  Cost to Build Sk//KW 15 3 3 2 2 2 40 667  Facilities Maint \$k/Yr 150 70 70 20 40 66  CDO/OPS FTE 1.00 0.50 0.10 0.50 0.25 0.25 1.06  Sysadmin Networking FY05 FY08 FY07  Elec \$k/KW-HR 0.048 0.052 ?  Upgrades FY02 FY03 FY04 FY05 FY08 FY07 Total FCC Gen/UPS 3.5  FCC add 2 100 k/X UVA UPS CC GRA GCC CRA GCC CRB GCC CRB GCC CRB GCC CRC GCC C										
Watts/Sq Ft	Watts/Sq Ft	42	327		365	133	183			70
Cost to Build Sk/kW 15 3 3 3 2 2 2 4 4 5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Rack Space									
SK/KW	Watts/Sq Ft	212	1667		1667	1042	1763			650
SK/KW	Cost to Build									
Facilities  Maint \$K/Yr		15	3		3	2	2			4
Maint \$K/Yr						-	<del></del>			
CDO/OPS FTE 1.00 0.50 0.10 0.50 0.25 0.25 1.00  Sysadmin  Networking  FY05 FY08 FY07  Elec \$/KW-HR 0.048 0.052 ?  Upgrades FY02 FY03 FY04 FY05 FY06 FY07 Total  FCC Gen/UPS 3.5  FCC add 2 100 KVA UPS 0.5  FCC ICW pipe replace pipe per pelace GCC CRA GCC CRA GCC CRB 0.3  GCC CRB 0.675 GCC CRC CRC CRC CRC CRC CRC CRC CRC CRC		150	70		70	20	40			80
Sysadmin		150	//		/0	20	40			- 00
Sysadmin  Networking  FY05 FY08 FY07  Elec \$/KW- HR										
Networking	FIE	1.00	0.50	0.10	0.50	0.25	0.25			1.00
Networking										
FY05	Sysadmin									
FY05										
Elec \$/KW- HR	Networking									
Elec \$/KW- HR										
Elec \$/KW- HR		FY05	FY06	FY07						
HR 0.048 0.052 ?  Upgrades FY02 FY03 FY04 FY05 FY06 FY07 Total  FCC Gen/UPS 3.5  FCC add 2 100 KVA UPS 0.5  FCC ICW pipe replace GCC CRA GCC CRA GCC CRB 2.2  GCC CRB 0.36  GCC CRB 0.675  GCC CRC 0.675	Flec \$/KW-									
Upgrades FY02 FY03 FY04 FY05 FY06 FY07 Total  FCC Gen/UPS 3.5  FCC add 2 100 kVA UPS 0.5  FCC ICW pipe replace GCC CRA 2.2  GCC CRB 2.9 1.8  GCC CRB CCC CRC CCC CCC CCC CCC CCC CCC C		0.048	0.052	2						
FCC Gen/UPS FCC add 2 100 KVA UPS 0.5 FCC ICW pipe replace GCC CRA GCC CRB GCC CRB GCC CRB GCC CRB GCC CRC Add Elec 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	THE	0.040	0.002	<u> </u>						
FCC Gen/UPS FCC add 2 100 KVA UPS 0.5 FCC ICW pipe replace GCC CRA GCC CRB GCC CRB GCC CRB GCC CRB GCC CRC Add Elec 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	Ungrades	EV02	EV03	EV04	EV05	EVDS	EV07	Total		
Gen/UPS 3.5 FCC add 2 100 KVA UPS 0.5 FCC ICW pipe replace GCC CRA GCC CRB 2.2 GCC Tape Robot room GCC CRC 2 Add Elec 0.1 0.1 0.1 0.1 0.1 0.1		1102	1 100	1104	1 100	1 100	1 107	i otali		
FCC add 2 100 kVA UPS		2.5								
100 KVA UPS		3.0								
UPS 0.5 FCC ICW pipe replace 0.3 GCC CRA 2.2 GCC CRB 2.9 1.8 GCC Tape Robot room 0.675 GCC CRC 2 Add Elec 0.1 0.1 0.1 0.1 0.1 0.1										
FCC ICW pipe replace			۰.							
pipe replace 0.3  GCC CRA 2.2  GCC CRB 2.9 1.8  GCC Tape Robot room 0.675  GCC CRC 2  Add Elec 0.1 0.1 0.1 0.1 0.1 0.1			0.5							
GCC CRA 2.2  GCC CRB 2.9 1.8  GCC Tape Robot room GCC CRC 2  Add Elec 0.1 0.1 0.1 0.1 0.1 0.1										
GCC CRB 2.9 1.8 GCC Tape Robot room GCC CRC 2 Add Elec 0.1 0.1 0.1 0.1 0.1 0.1 0.1			0.3							
GCC Tape Robot room GCC CRC Add Elec 0.1 0.1 0.1 0.1 0.1 0.1 0.1					2.2					
Robot room         0.675           GCC CRC         2           Add Elec         0.1         0.1         0.1         0.1         0.1						2.9	1.8			
GCC CRC 2 Add Elec 0.1 0.1 0.1 0.1 0.1 0.1										
Add Elec 0.1 0.1 0.1 0.1 0.1 0.1	Robot room					0.675				
	GCC CRC						2			
Total 3.6 0.9 0.1 2.3 3.7 3.9 14.5	Add Elec									
	Total	3.6	0.9	0.1	2.3	3.7	3.9	14.5		

9

## Some Observations

- · Space, Power, Cooling is important and it is expensive.
- It would be wise to do as much as possible in common to save effort, to learn from each other, to gain some leverage from all the efforts.
- Fermilab is not significantly better or worse than any other place in how we acquire commodity PCs.

## Issues to be resolved

- Weight to be put on various costs and benefits in the bid evaluation formula.
  - Performance/dollar.
  - Performance/watt.
  - Lifetime costs.
  - Other.
- Vendor evaluation process.
- How to speed up acquisitions.
- · Delivery schedule and acceptance process:
  - All at once vs. a few racks at a time
  - 2 weeks vs. 30 days.
- Racking strategies.
- Commonality of acquisition process across the Division.

### The Plan/Conclusions

- We will hear some more detailed reports over the next couple of weeks.
- Then we will work on recommendations with the goal of having them to Vicky well before the large FY06 purchases and certainly as early as possible given the lead time needed for evaluation, requisition-writing, approvals, etc.